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As data processing operations assume great significance in the overall operation and financial activities of organizations, the exercise of firm control over the data processing function becomes critically important. Similarly, the substantial impact of data processing on the financial records of clients dictates the need for a greater involvement and expertise by the auditor.

The Audit and Control Functions

Auditing is an attest function involving objective review and evaluation of the fairness and authenticity of the records, measurements, and financial reports prepared by the management of an organization. The audit function can be performed by an independent agent whose primary obligation is to the readers of the financial statements and reports on which an opinion is given. These readers may include the management commissioning the audit, but are primarily individuals external to the organization such as investors, creditors, and government agents. The objective of the ordinary review of financial statements by the independent auditor is the expression of an opinion on the fairness with which they present financial position, results of operations, and changes in financial position in conformity with generally accepted accounting principles.

The audit function can also be performed primarily for the internal use of management in evaluating either the accuracy or the efficiency of the record-keeping and other activities of the organization. In this instance the service is performed by employees of the organization and is a form of the audit function referred to as internal auditing.

No less concerned with the accuracy and efficiency of the reporting technique is management which bears the ultimate responsibility for the successful operations of an organization. In discharging its responsibility, management is dependent upon the quality of information available to it. Thus, in addition to supporting an internal audit function to review the adequacy of internal operations, management has the primary responsibility for providing for the existence of control procedures which will insure that all data are properly recorded, that the recording process includes proper verification procedures, that safeguards exist to prevent duplication of proper data or inclusion of extraneous data, that proper security and classification of the data so recorded is maintained. The control function can be characterized as that set of prescribed operations or procedures aimed at insuring the accomplishment of a particular goal — in this instance protection of the integrity of the financial records.

There is a commonality of interest in the accuracy of financial records and, therefore, a potential for common use of many techniques in the data collection, analysis, and reporting process. In its *Statement on Auditing Standards*, the American Institute of Certified Public Accountants has stated its view of the related concerns and responsibilities of auditors and management.[1]

Computer-Introduced Changes in Traditional Accounting and Audit Techniques

Computers and their related support equipment (i.e., keypunches, transmission equipment, etc.) have not in any significant way altered established accounting theory as it relates to the kind of data to be collected or the manner in which such data are to be organized for reporting purposes. But the computer has substantially altered the methods by which that theory is put into practice. As the collection and subsequent uses of data are changed from manual procedures frequently performed by individuals who had some familiarity with both the data and the accounting process to high-volume, automated techniques frequently performed by individuals who are unfamiliar with both the data and accounting practices, the opportunities for personal scrutiny and clerical checking have declined. For example, a keypunch operator handling large volumes of data, switching frequently from one type of information to another, and frequently working with coded data, has neither the time nor information to be concerned with the accuracy of the data being punched. The only reasonable expectation is that the keypunch operator will take steps to control the accuracy of the transcription process itself.

Huge increases in the volume of transactions have mitigated against close scrutiny of individual transactions. Only techniques which emphasize standardized automatic operations are practical in a high volume environment. Mechanized verification and programmed scanning for objectively defined conditions such as absence of specific data items or failure to meet previously defined "reasonableness limits" are useful.

The introduction of data-processing equipment requires a certain concentration of the recording and processing functions in departments which are more separated from the origin of the data than

in times past and which also tend to eliminate the separation of responsibilities which previously characterized the record-keeping function. A trend towards integration of operating and financial data in corporate information systems or data bases further eliminates independent records which might have previously provided a source of comparative or contrasting data. At the same time, integrated information system can become the basis for more vital and timely management decisions.

Besides eliminating departmental (and even geographical) separation of the recording units, computerization has also reduced substantially the time involved in the accounting cycle. Data are used much more rapidly than before, and the lag between capture and use of data during which recording errors might have been discovered before they had an impact on operations has been substantially reduced or even eliminated in the case of real-time systems. This has heightened the pressure for increased care in the recording process.

Many records are no longer stored in hard copy which is intelligible to humans. Instead data are stored in machine-readable format and intermediate results are not printed. Changes in the recording media and the elimination of many clerical procedures have been combined to eliminate many of the traditional audit trails by which individual records can be traced to final reports or back to the original transaction. There is also an educational lag which makes it difficult for non-data processing personnel to fully understand the system and critically evaluate its performance.

Professional Standards and Responsibilities

The American Institute of Certified Public Accountants has adopted as part of its Code of Professional Ethics, a statement of generally accepted auditing standards.[2] The standards are divided into three groups: General Standards; Standards of Field Work; and Standards of Reporting. The General Standards and the Standards of Field Work have particular significance when considering the implications of auditing in the computerized environment.

General Standards

1. The examination is to be performed by a person or persons having adequate technical training and proficiency as an auditor.
2. In all matters relating to the assignment, an independence in mental attitude is to be maintained by the auditor or auditors.
3. Due professional care is to be exercised in the performance of the examination and preparation of the report.

These standards are quite explicit in their requirement that the professional auditor have a functional knowledge of computer systems — including both how to use those systems for the audit function and how to test the systems to evaluate properly their results. The auditor must have sufficient training to enable him/her to read and use documentation commonly used in computer organization.

It is not necessary that auditors be specialists in advanced systems design or programming techniques — but they must have sufficient personal knowledge to form their own judgments independently. It is completely inappropriate to rely upon others to make professional judgments. An acceptable exception occurs when a team of independent auditors contains an EDP specialist.

Standards of Field Work

1. The work is to be adequately planned and assistants, if any, are to be properly supervised.
2. There is to be a proper study and evaluation of the existing internal control as a basis of reliance thereon and for the determination of the resultant extent of the tests to which auditing procedures are to be restricted.
3. Sufficient competent evidential matter is to be obtained through inspection, observation, inquiries and confirmations to afford a reasonable basis for an opinion regarding the financial statements under examination.

Many computer activities involve cyclical patterns which the auditor should consider. By so doing advantage can frequently be taken of existing control procedures employed by the installation. In other instances proper evaluation may require a series of tests through the time cycle to adequately sample the system. The requirement for proper supervision, as always, implies that the senior in charge be sufficiently knowledgeable to evaluate the work of all assistants.

The increase in file integration and the introduction of new techniques such as those employed in data base systems and real-time systems are quickly making it impractical for an auditor to limit the review of internal control to reviewing manual procedures for capturing and transmitting data. Increasingly, controls are being incorporated into the computer programs themselves. Consequently, the auditor must be able to understand, evaluate, and even use these control techniques.

Evidential matter in a system which is heavily dependent on computerized controls and processing procedures draws heavily from the documentation of the processing procedures and programs of the system. This documentation frequently consists of record layouts, program listings, flowcharts, decision tables, and run manuals. These documents represent the client's formal description of the system and an accurate understanding of these materials can help the auditor design a test program. Also important are the listings and calculations assembled by the auditor when examining and evaluating the client's data itself. Since much client data is in machine readable form, the auditor must devise techniques to interrogate those machine records to verify their accuracy.

Computer systems are becoming all-encompassing and frequently represent the major source of data collection and processing capability in the client's total information system. As a result, computers usually have a material effect on the client's financial statements. Many computer users are searching for ways to reduce printed output as much as possible leading to a potential weakness of traditional audit trails. This is occurring at the same time a trend is taking place toward a greater concentration of processing and internal control in the computer system. The real impact of computers on the financial information system makes an ability to understand and evaluate the EDP system imperative. Further, the nature of existing computer facilities and data files often requires that the auditor actually use the computer to perform many audit procedures. The sheer volume and technical nature of many of the client's records make use of the computer technically and economically necessary to the auditor.

These considerations indicate a minimum knowledge requirement for all persons engaged in public accounting-auditing. The study defining the Common Body of Knowledge makes the following recommendations:

1. The beginning CPA should have basic knowledge of at least one computer system. This implies a knowledge of the functions of the component parts, of the general capabilities of the system, and of the more universal terms associated with the computer.

2. He should be able to chart or diagram an information system of modest complexity. This means that he should be able to comprehend the procedural steps in a system and utilize basic diagram symbols that describe the system clearly and precisely.

3. He should have a working knowledge of at least one computer language. We recommend no specific language, but there are several relatively universal languages that would serve better than those with more limited applicability. With an understanding of a programming language together with his overall knowledge of information systems, the beginning CPA should be in a position to design a simple information system, program it, and proceed to debugging and testing.[3]

A more comprehensive listing was developed in the article, "Technical Proficiency for Auditing Computer Processed Accounting Records" which suggests that the general audit staff member should:

A. Understand basic computer concepts: — not only the functions of the central processing unit itself, but the manner in which data are written on peripheral equipment —
B. Understand and be able to analyze the concentration of controls in an EDP environment.
C. Understand systems flowcharts and descriptions of computerized systems.
D. Have general familiarity with at least one computer programming language.
E. Understand in a general way the use of computer auditing software.
F. Understand concepts of file processing.
G. Know when to call for the assistance of a computer audit specialist.[4]

The preceding qualifications represent a *minimum* level of knowledge for all general audit staff members. In situations involving highly complex and sophisticated systems it may be necessary to develop an audit team which includes a computer specialist who can provide the technical expertise needed. It is impossible for every auditor to be an expert in computer and data processing technology, for computer science is a highly complex and rapidly changing field which is professionally demanding in its own right. But the auditor in charge of an audit must have sufficient technical knowledge of the computer field so that he or she can, in fact, take responsibility for supervising the work done by the computer audit technician and for properly directing and using the work of the computer expert.

Growth in the Use of Computer Systems

The number of computer installations in the United States increased from 5000 installations in 1960 to 107,000 in 1973 and is projected to reach 200,000 by 1975.[5] In addition to the numerical growth there has been an increase in the sophistication of their use. This very substantial growth in computer installations was aided by several technological developments. Hardware has been made faster and at the same time less expensive so that the resulting savings in the cost per unit of information stored is substantial. This lowered cost plus the development of practical large scale storage makes true integrated corporate data systems feasible. At the same time computer manufacturers have introduced small scale equipment (frequently called mini-computers) which have made computer facilities practical for small organizations as well.

Modern computers have provided an environment where it has been possible to service ever larger areas from centralized locations and to generate more detailed, accurate information for management in a shorter period of time. The computer has facilitated the standardization and integration of total company information systems. Increasingly these information systems are expanding beyond the limits of classical financial and accounting data to encompass a broad range of operating information useful for decision-making. Many of these systems are shortening the recording and processing cycle to an environment in which transactions are recorded and processed as they occur and through which management can continuously monitor company performance and make immediate operating decisions in response to any exceptional conditions.

Opportunities Presented by the Computer

While computerization has eliminated some of the traditional audit trails and control techniques, it has opened many new opportunities for improving the audit and the control functions. Computers operate consistently and rapidly — thus they are capable of examining much larger volumes of data with fewer errors than could be done manually. This attribute makes it possible to economically audit large scale firms with their extremely high volume of activity without pricing the audit service beyond the reach of many firms.

When auditors are sufficiently familiar with computers to use them and client files are already conveniently recorded in machine readable form, statistical sampling is easily implemented. The size of sample can now be varied easily to suit the auditor's needs without the practical complications inherent in manual methods. Where warranted, auditors can use one of their own programs to quickly scan every record in a large client file. Further, an auditor can use the computer to analyze account relationships and materiality. Verification of payroll calculations, and extension of price x quantity to calculate inventory values are but two of many ways in which the auditor can substitute computer time for staff time.

Still another use of the computer in the audit function is testing the system itself. Frequently, the auditor must spend substantial time analyzing the effectiveness of the accounting and control system. Through the use of test data the ability of computer programs to properly recognize and handle transactions can be tested. Further, programs can be used to compare actual results with test results, to compare one version of a program to another, or to diagram the logic of a client program.

All of these potential benefits exist for the professional auditor who has a solid working knowledge of computer systems. They can often provide better performance of the attest and evaluation function than many of the traditional techniques when applied to computerized record-keeping procedures.

Footnotes

[1]Committee on Auditing Procedures, *Statement on Auditing Standards*, (New York: American Institute of Certified Public Accountants, 1973), paragraphs 110.01 and 110.02, pp. 1-2.

[2]Statement on Auditing Standards, paragraph 150.02, pp. 4-5.

[3]Robert H. Roy and James H. MacNeill, *Horizons for a Profession*, (New York: American Institute of Certified Public Accountants, 1966), p. 213.

[4]Richard W. Cutting, Richard J. Guiltinan, Fred L. Lilly, Jr., "Technical Proficiency for Auditing Computer Processed Accounting Records," *The Journal of Accountancy*, (October 1971), pp. 76-78.

[5]"Computer Industry Profile," compiled by International Data Corporation for *Computerworld*, 1973.